10. MODULE
Repetitive Tasks

INTRODUCTION

Scope of application. The module Repetitive Tasks allows you to analyze repetitive activities of the upper limb activities with clearly defined work cycles, in order to assess the risk of musculoskeletal injury in the neck-shoulder area and the hand-wrist area.

Contents. The exposure time and the repetitiveness of the movements of both the arms and hands are determined in the different subtasks that make up the task performed by the worker. Likewise, the main postures adopted in each subtask are analyzed.

From these data several risk levels are obtained (between I and IV), which are associated with the task carried out throughout the workday. In addition, the module provides recommendations to reduce the risk levels when they are high (levels III and IV).

When applying this procedure, it is advisable to record the task on video during a representative period of time.

Source. This module is the result of a research project developed by the IBV in collaboration with the work accidents mutual insurance company Union de Mutuas and the union trade Comisiones Obreras [IBV, Unión de Mutuas y CC.OO., 1996].

DATA

The analysis starts by selecting the module *Repetitive Tasks* in the *New Task* window (Figure 1).

This opens the main window of this module (Figure 2) where the data required to calculate the risk are entered.

Figure 1. Access to the module Repetitive Tasks
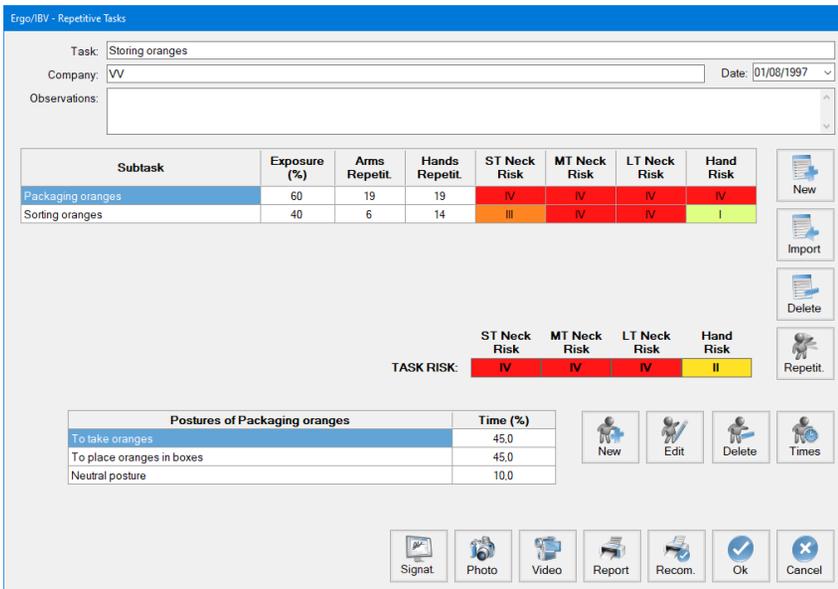
Figure 2. Repetitive tasks – Main window

- **Identification**. Name of the task and company, analysis date and relevant observations.

- **Subtasks**. The different *subtasks* that make up the task of the worker during the working hours are defined in the upper table. For example, Figure 2 shows the task of storing oranges, for which the worker spends part of the working hours performing the subtask "*placing oranges in boxes*" and the rest of the time "*sorting or selecting oranges*".

- **Postures**. Another table at the bottom of the screen shows the main postures adopted by the worker when performing each defined subtask. For example, according to figure 2, during the subtask "*placing oranges in boxes*" (selected above) the postures "*seizing oranges*", "*putting oranges in box*" and also "*neutral posture*" are adopted way the worker.

The *Delete* button next to the table of subtasks allows you to remove the selected subtask and all the associated postures. Similarly, by pressing the *New* button you add a new row to the table of subtasks.

With the *Import* button you can incorporate the analyses of other repetitive tasks that are located in the same work folder. Importing a file adds to the table of subtasks those subtasks contained in the file of the task that has been imported (Figure 3), keeping the repetitiveness of the original subtasks and putting a zero in the Exposure (%) box (Figure 4).

Figure 3. Repetitive subtasks – Import tasks
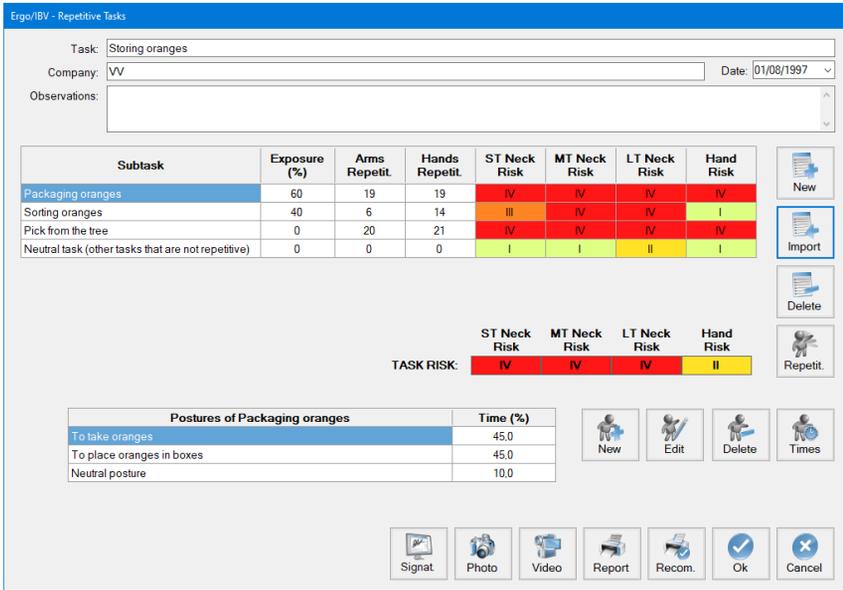
Figure 4. Repetitive tasks – Main window after importing tasks

The program calculates the risk of the task and the subtasks that make it up from the information entered for both the subtasks and the corresponding postures.

- **Risk of the task**. It reflects the risk levels of the task analyzed as a whole, distinguishing between the risk to the *neck-shoulder area* (short, medium and long term) and to the *hand-wrist area*. There are four risk levels considered in this module, which are interpreted as follows:

  Level I   Work conditions ergonomically acceptable.

  Level II   The conditions could be improved, but do not require immediate intervention.

  Level III   The conditions require intervening as soon as possible.

  Level IV   The conditions require immediate intervention.

  For example, according to Figure 2, the task of storing oranges poses a risk level IV (implies immediate intervention) to the neck area in the LT, MT and ST, whereas the risk level to the hand is level II (the conditions could be improved, but immediate intervention is not necessary).

- **Risk of the subtasks**. It shows the risk levels (for the neck-shoulder and hand-wrist areas) calculated for each subtask independently, as if the worker performed only the subtask under study. The objective is to estimate the risk that each subtask would pose with an exposure time of 100% instead of the current one. This information may be useful to help the evaluator see how the risk levels of the task could vary as a whole by changing the exposure times of the different subtasks.

As it was already mentioned, it is advisable to record the worker on **video** while performing each subtask during a representative period of time. Watching this video later will allow you to obtain the data required for the subtasks and the corresponding postures.

Hoy to enter the information in the table of subtasks and postures is described below.

Subtasks

The data required for each row of the table of subtasks are as follows (Figure 2):

- **Subtask**. Enter the name of the subtask by selecting and typing directly in the corresponding box.

- **Exposure (%)**. It is the exposure time of the subtask with respect to the total task, expressed as a percentage (percentage of the time that the subtask takes during the task), and it is also entered by directly typing in the box. The sum of the percentages of exposure of all the subtasks entered must be 100% of the task; this means that the program does not consider the existence of rest periods and, therefore, they must be entered as an additional subtask.

- **Arms repetitiveness**. It is the repetitiveness of the arm movements during the subtask, expressed as the number of repetitions per minute.

- **Hands repetitiveness**: It is the repetitiveness of the hand movements during the subtask, expressed as the number of repetitions per minute.

The *exposure (%)* is obtained from the information available in the company, by asking the worker or the person in charge.

The data regarding *arm and hand repetitiveness* are obtained from the analysis of the video recording. The evaluator can enter this information manually in the boxes of the subtask (Figure 2), or use a utility of the program that assigns repetitiveness automatically, which is explained below:

Repetitiveness assignment. This utility consists of a chronometer and a movement counter which are used while watching the video in order to calculate the number of movements per minute. To do so, follow the following steps:

o Select the relevant subtask from the table of subtasks (Figure 2) and press the *Repetit.* button on the right so as to access the *Repetitiveness* window (Figure 5.a).

o In this window, select the *movements to be counted* (arms or hands) by checking the corresponding box; this will enable the associated button on the left.

o Press the *Video* button to display the *video player* window (Figure 6), if it was not already displayed. With the commands of this player, locate in the video the point from where you want to start counting the movements and freeze the image. It is important to note that from this moment on, the video must be controlled by using the buttons in the *Repetitiveness* window (not with the commands of the player).

o Press the *Start* button in the *Repetitiveness* window (Figure 5.a) to start the sampling, and press the *Movements* button (of the arms or hands) each time this movement occurs (you can also press the *Enter* button on the keyboard). The process can be stopped with the *Stop* button and be resumed with the *Continue* button (which is only visible during the sampling). This window shows the number of movements as they are counted and the accumulated sampling time (Figure 5.b).

o When the analysis is completed, stop the chronometer with the *Stop* button.

o When pressing the OK button, the program automatically enters the repetitiveness value in the corresponding box of the table of subtasks (Figure 2).
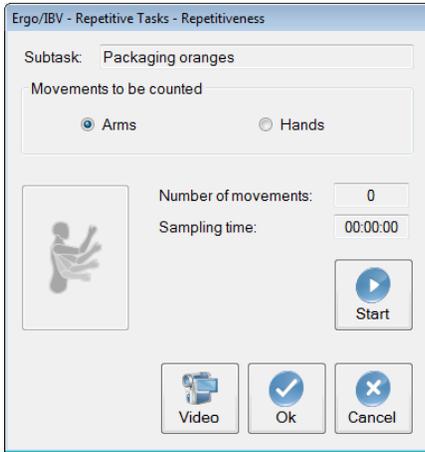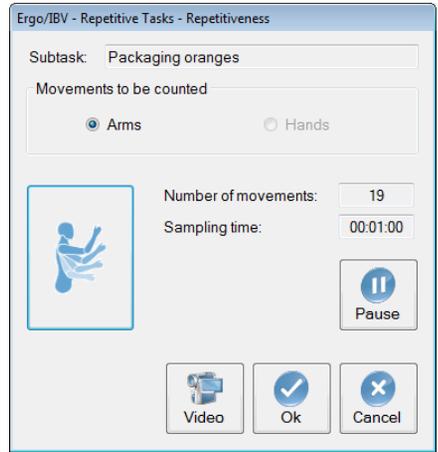
Figure 5. Repetitive tasks – Repetitiveness:
a) main window, b) during the sampling

Figure 6. Video player

Postures

To create a posture, select the relevant subtask from the table of subtasks and then click the *New* button next to the table of postures (Figure 2). You will access the *Posture* window (Figure 7), where the following is recorded:

- **Posture**. Specify the name of the posture.

- **Time (%)**. Specify the time that this posture takes with respect to the total time of the subtask, expressed as a percentage. Obviously, the percentages of all the postures of the same subtask should sum to 100% of the time of the subtask.

- **Posture encoding**. Three body areas must be encoded for each posture (neck, arms and wrists), which are located under two tabs (Neck-Arm) and (Hand-Wrist). The encoding is done by viewing the video of the task and entering the data detailed below.

   Neck (Figure 7)

   - o Flexion or extension. Specify the position of the neck by pressing one of the following buttons:
       - Flexion 0-10º
       - Flexion 10-20º
       - Flexion > 20º
       - Extension

   - o Torsion. Press this button only if the neck turns (in either way) are noticeable.

   - o Lateral tilt. Press this button only if the neck lateral tilt (to the right or left) is noticeable.

   Arms (Figure 7)

   - o Flexion or extension. Specify the position of the arm by pressing one of these buttons:
       - Extension > 20º
       - Position between 20º extension and 20º flexion
       - Flexion 20-45º
       - Flexion 45 -90º
       - Flexion > 90º
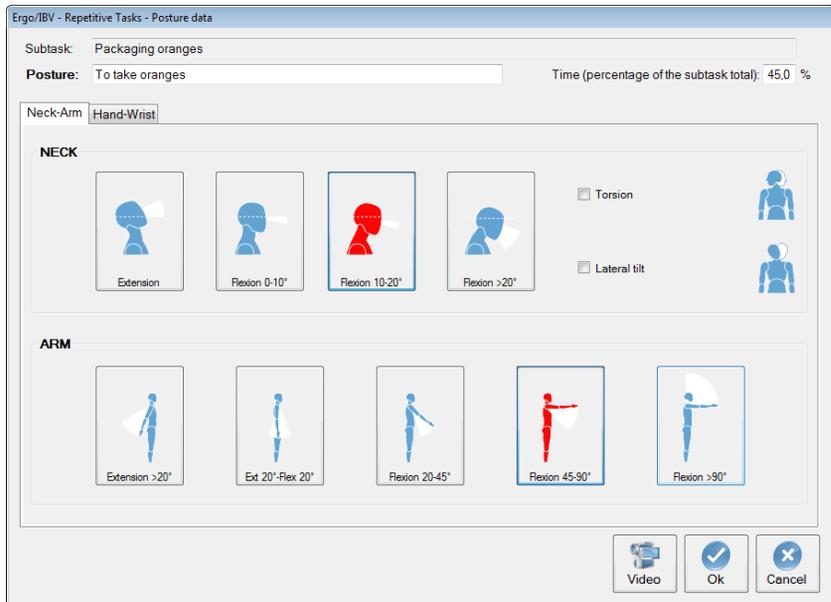
Figure 7. Repetitive tasks – Posture (Neck-Arm encoding)

Wrists (Figure 8)

- o Flexion or extension. Specify the position of the wrist by pressing one of these buttons:
  - Neutral position (0º), there is no flexion or extension
  - Flexion or extension < 15º
  - Flexion o extension > 15º
- o Pronation/supination. Press this button only if the hand turn (in either way) is noticeable.
- o Radial/ulnar deviation. Press this button only if the radial/ulnar deviation of the hand is noticeable.
- o Hand effort. Specify the intensity of the hand effort by pressing one of the following buttons:
  - Light task (< 10% of the maximum force)
  - Slightly hard task (10-30% of the maximum force)
  - Hard task (30-50% of the maximum force)
  - Very hard task (50-80% of the maximum force)
  - Close to the maximum (> 80% of the maximum force)
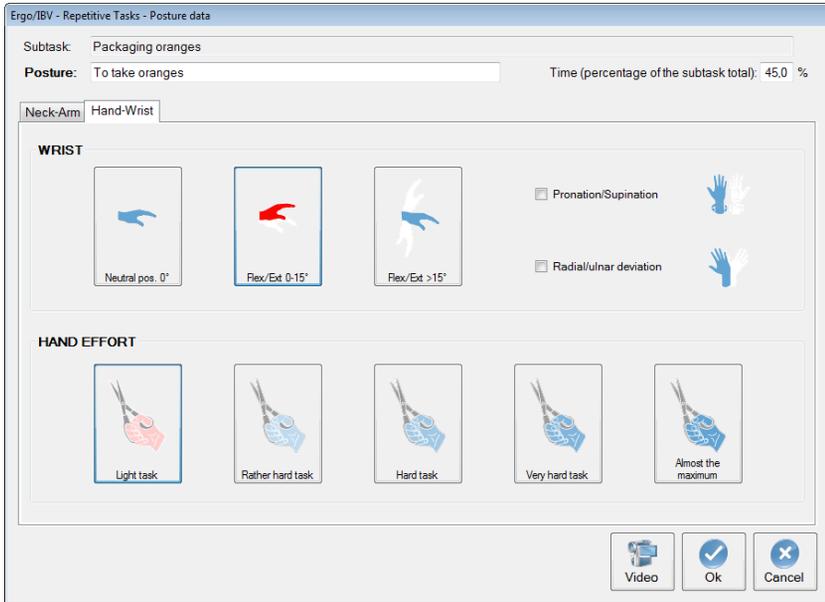
Figure 8. Repetitive tasks – Posture (Hand-Wrist encoding)

The functions of the buttons next to the table of postures (Figure 2) are as follows:

- *New*: it lets you enter a new posture.
- *Edit*: it allows you to modify the data of a posture.
- *Delete*: this button eliminates the selected posture.
- *Times*: this command accesses a utility of the program to automatically assign the time percentage that each posture takes during the subtask while watching the video recording (its operation is explained below); as mentioned above, the data can also be manually entered in the appropriate box, (Figure 7).

Assignment of times. This utility includes a chronometer and works in a similar way to how repetitiveness is assigned, which was previously described. This utility can be applied as follows:

- o From the table of subtasks (Figure 2), select the one whose postures you want to analyze and press the *Times* button next to the table of postures. You will access the *Times* window (Figure 9), where there is a button for each posture defined in that subtask.

- o Press the *Video* button to display the window of the *video player* (Figure 6), if it was not already displayed. With the commands of this player, locate in the video the point where the subtask starts and freeze the image. It is important to note that from this moment on, the video must be controlled by using the buttons in the *Times* window (not with the commands of the player).

- o Press the *Start* button in the *Times* window to start the sampling, and select from the table the postures that the worker adopts. Each posture has an associated counter (which accumulates time while the position remains selected); the cumulative total sampling time is also displayed (Figure 9).

- o When the analysis is completed, stop the chronometer with the *Stop* button.

- o When pressing the OK button, the program automatically enters the corresponding values in the *Time* (%) column of the table of postures (Figure 2).
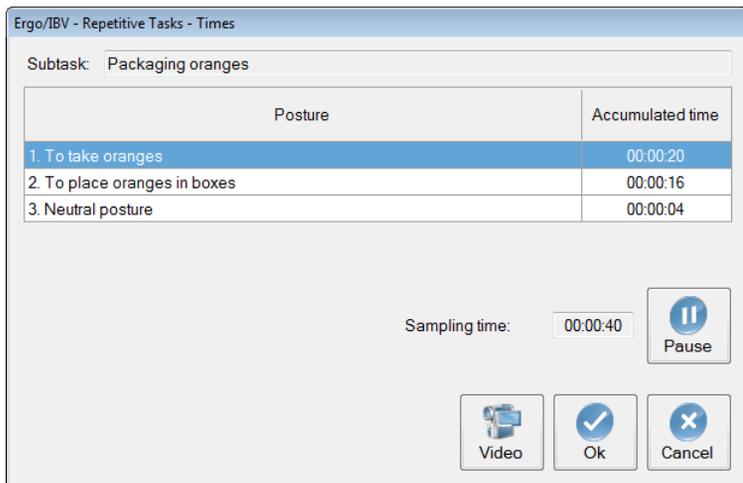
Figure 9. Repetitive tasks – Assignment of the posture times

In addition to selecting with the mouse, you can also press a keyboard button with the number that is associated with the posture. This way you can select postures without taking your eyes off the video.

Neutral posture. Every time a new subtask is created, the program adds (by default) a posture called *Neutral Posture*, which may be associated with a rest posture in the subtask. This position appears encoded with the relevant data (most favorable positions of the neck, arms and wrists) and therefore the evaluator simply assigns the percentage of *Time*. If the *neutral position* in not used in a particular subtask, the evaluator should delete it so that it will not be shown in the program window and the report.

REPORT

Pressing the *Report* button in the main window of this module (Figure 2) opens the *task report,* which includes the following sections:

- **Identification**. It includes the general data that identify the case (date, task, company, observations) and an image of the task (if a photograph was added).
- **Data** (Figure 10). It shows the subtasks that make up the task; each subtask includes the exposure, repetitiveness of arms and hands, and the main postures considered together with the corresponding time.
- **Risk of the task** (Figure 11). It shows the risk levels of the task analyzed as a whole, distinguishing between the risk to the *neck-shoulder area* (short, medium and long term) and to the *hand-wrist area*. There are four risk levels considered in this module, which are interpreted as follows:

Level I	Work conditions ergonomically acceptable.
Level II	The conditions could be improved, but do not require immediate intervention.
Level III	The conditions require intervening as soon as possible.
Level IV	The conditions require immediate intervention.

The report associates color codes with different levels of risk. Levels III and IV are considered high risk, and the recommendations offered by the program are intended to such levels.

- **Risk of the subtasks** (Figure 12). It shows the risk levels (for the neck-shoulder and hand-wrist areas) calculated for each subtask independently, as if the worker performed only the subtask under study. The objective is to estimate the risk that each subtask would pose with an exposure time of 100% instead of the current one. This information may be useful to help the evaluator see how the risk levels of the task could vary as a whole by changing the exposure times of the different subtasks.
- **Postures** (Figure 13). It displays the details of all the postures analyzed one by one. Each posture shows the name of the subtask to

which it belongs, the name of the posture along with the percentage of time, and all the encoding details.

DATA				
Subtasks	Exposure (% of total task)	Arms Repetitiveness	Hands Repetitiveness	Postures - Time (% of total subtask)
Packaging oranges	60%	19 reps/min	19 reps/min	• To take oranges - 45,0 % • To place oranges in boxes - 45,0 % • Neutral Posture - 10,0 %
Sorting oranges	40%	6 reps/min	14 reps/min	• Controlling quality - 80,0 % • Neutral Posture - 20,0 %

Figure 10. Repetitive tasks – Task report (data)

RISK of the TASK			Evaluator (name and signature)
		Risk Level	
NECK-SHOULDER area	in the short term	IV	
	in the medium term	IV	
	in the long term	IV	
HAND-WRIST area		II	

Interpretation of the Risk Level	
Level I	Situations that are ergonomically acceptable.
Level II	Situations that can be improved but do not require an immediate intervention.
Level III	Situations that require an intervention as soon as possible.
Level IV	Situations that require an immediate intervention.

Figure 11. Repetitive tasks – Task report (risk of the task)

Figure 12. Repetitive tasks – Task report (risk of the subtasks)

Figure 13. Repetitive tasks – Task report (postures)

RECOMMENDATIONS

When risk levels III or IV are detected, you can open a *recommendations report* by pressing the *Recom.* button in the main window of the module (Figure 2). This report, in addition to the **identification** data and the **task risk** data, contains the following information:

- **Recommendations to reduce the risk** (Figure 14). Several recommendations that reduce one level of risk (that is, from level IV to level III, or from level III to level II) are offered for the relevant body areas. Each of these suggestions decreases the level of risk itself, and the evaluator must choose the most suitable one.

- **Meaning of the recommendations** (Figure 15). More detailed information on the above recommendations specifies on which subtask or posture they should be applied, and which action is required.

Figure 14. Repetitive tasks – Recommendations report
(recommendations to reduce the level of risk)

MEANING of the RECOMMENDATIONS

• Improve the neck posture

This implies acting on   **Posture (Subtask):**   Required action:

Controlling quality (Sorting oranges)	Change from >20° flexion to 10-20° flexion.

• Highly improve the neck posture

This implies acting on   **Posture (Subtask):**   Required action:

To place oranges in boxes (Packaging oranges)	Change from >20° flexion to 0-10° flexion.
Controlling quality (Sorting oranges)	Change from >20° flexion to 0-10° flexion.

• Improve the arm repetitiveness

This implies acting on   **Subtask:**   Required action:

Packaging oranges	Change from 19 to 9 reps/min.

Figure 15. Repetitive tasks – Recommendations report
(meaning of the recommendations)